The objects of this new series are not only to publish new tables (as well as to republish old and inaccessible tables), but also in due course to issue works on interpolation, mechanical quadratures, calculating machines, and other matters of importance to the practical computer. The first of the series is before us, and is entitled *Tables of the Digamma and Trigamma Functions*, by Eleanor Pairman. The work contains tables of the logarithmic derivate of the Gaussian Π-function and of its derivate, in addition to some useful miscellaneous information concerning these two functions. The functions are tabulated to eight places of decimals at intervals of 0.02 from 0 to 16, with tables of second differences. There seems no doubt that this series will be of extreme value to computers, and we must feel deep gratitude to Prof. Pearson for using the resources at his disposal in producing it. Finally, it should be said that the appearance of the first of the series is up to the standard which we have grown accustomed to expect from the Cambridge University Press."

ARTICLES IN CURRENT PERIODICALS.

Annals of Mathematics, 2d series, volume 21, no. 1, September, 1919: "Investigation of a class of fundamental inequalities in the theory of analytic functions" by J. L. W. V. Jensen [translation from the Danish by T. H. Gronwall], 1–29; "Functions of limited variation in an infinite number of dimensions" by P. J. Daniell, 30–38; "A new sequence of integral tests for the convergence and divergence of infinite series" by R. W. Brink, 39–60; "Calculation of the complex zeros of the function $P(z)$ complementary to the incomplete gamma function" by P. Franklin, 61–63; "Total differentiability" by E. J. Townsend, 64–72.

Athenaeum, 1919, November 14: "Einstein's theory of gravitation" by X., 1189 [Last paragraphs: "Einstein supposes that space is euclidean where it is sufficiently remote from matter, but that the presence of matter causes it to become slightly non-euclidean—the more matter there is in the neighbourhood, the more space will depart from Euclid. By the help of this hypothesis, together with his previous theory of relativity, he deduces gravitation—very approximately, but not exactly, according to the Newtonian law of the inverse square.

"The minute differences between the effects deduced from his theory and those deduced from Newton are measurable in certain cases. There are, so far, three crucial tests of the relative accuracy of the new theory and the old.

"(1) The perihelion of Mercury shows a discrepancy which has long puzzled astronomers. This discrepancy is fully accounted for by Einstein. At the time when he published his theory, this was its only experimental verification.

"(2) Modern physicists were willing to suppose that light might be subject to gravitation, *i.e.*, that a ray of light passing near a great mass like the sun might be deflected to the extent to which a particle moving with the same velocity would be deflected according to the orthodox theory of gravitation. But Einstein's theory required that the light should be deflected just twice as much as this. The matter could only be tested during an eclipse among a number of bright stars. Fortunately a peculiarly favourable eclipse occurred this year. The results of the observations have now been published, and are found to verify Einstein's prediction. The verification is not, of course, quite exact; with such delicate observations that was not to be expected. In some cases the departure is considerable. But taking the average of the best series of observations, the deflection at the sun's limb is found to be 1.98″, with a probable error of about 6 per cent., whereas the deflection calculated by Einstein's theory should be 1.75″. It will be noticed that Einstein's theory gave a deflection twice as large as that predicted by the orthodox theory, and that the observed deflection is slightly *larger* than Einstein predicted. The discrepancy is well within what might be expected in view of the minuteness of the measurements. It is therefore generally acknowledged by astronomers that the outcome is a triumph for Einstein.

"(3) In the excitement of this sensational verification, there has been a tendency to overlook the third experimental test to which Einstein's theory was to be subjected. If his theory is correct as it stands, there ought, in a gravitational field, to be a displacement of the lines of the spectrum towards the red. No such effect has been discovered. Spectroscopists maintain that, so far as can be seen at present, there is no way of accounting for this failure if Einstein's theory in its present form is assumed. They admit that some compensating cause *may* be discovered to explain the discrepancy, but they think it far more probable that Einstein's theory requires some essential modification. Meanwhile, a certain suspense of judgment is called for. The new law has been so amazingly successful in two of the three tests that there must be something valid about it, even if it is not exactly right as yet.

"Einstein's theory has the very highest degree of aesthetic merit: every lover of the beautiful must wish it to be true. It gives a vast unified survey of the operations of nature, with a technical simplicity in the critical assumptions which makes the wealth of deductions astonishing. It is a case of an advance arrived at by pure theory: the whole effect of Einstein's work is to make physics more philosophical (in a good sense), and to restore some of that intellectual unity which belonged to the great scientific systems of the seventeenth and eighteenth centuries, but which was lost through increasing specialization and the overwhelming mass of detailed knowledge. In some ways our age is not a good one to live in, but for those who are interested in physics there are great compensations."]

Journal of the Indian Mathematical Society, volume 11, no. 4, August, 1919: "Progress report" by D. D. Kapadia, 121; "Mr. S. Ramanujan, B.A., F.R.S.," 122 and portrait frontispiece ["Was born of poor parents in December, 1888, at Erode in the Madras Presidency . . . In 1910 he went to Madras with two good sized note books filled with his researches in mathematics and with the help of some friends obtained a clerk's post in the Harbour Trust Office. This enabled him to remain in Madras and work at mathematics with the help of books and periodicals which were made accessible to him there. In 1912, having one day seen the remark in Mr. G. H. Hardy's tract on *Orders of Infinity* that the precise order $\rho(x)$ had not yet been ascertained and having himself arrived at a result relating to it, he opened correspondence with Mr. Hardy sending him some of his results on continued fractions and theory of numbers. Mr. Hardy was struck with the grandeur of the results and wrote to him an appreciative letter asking for more of his results in other branches of mathematics. On receiving these which were mainly in definite integrals and elliptic functions, Mr. Hardy discovered in Ramanujan a great mathematician and asked him if he would go to Cambridge . . . The University of Madras granted Mr. Ramanujan a special scholarship of the annual value of £250 for three years and he sailed for England in March, 1914 . . . An account of his work while in England has already appeared in the February, 1917 number of this *Journal*. . . . In recognition of his abilities in mathematics he was elected a fellow of the Royal Society in 1917, and in 1918 he was granted a Fellowship of Trinity. The University of Madras has also been pleased to give him an annual grant of £250 for another period of five years without imposing any conditions regarding residence or work. Since May 1917 he has not been keeping good health. He returned to India in March last for the sake of his health and is now residing . . . very near the place of his birth"]; "On the cartesian oval" by V. R. Aiyar, 123–144; "Some difficulties met with in reading mathematics without a teacher: a complaint against text-books" by W. A. Garstin, 145–154; "Astronomical notes" by T. P. B. Sastri, 155; Problems and Solutions, 156–160; "Mathematics (in brief) from current periodicals," i–iii.

Mathematics Teacher, volume 12, no. 1, September, 1919: "An experiment in motivation" by W. S. Schlauch, 1–9; "Scales for the study of children's characteristics" by E. S. Smith, 10–16; "Applied mathematics in high schools: some lessons from the war" by W. E. Breckenridge, 17–22; "A junior high school course in mathematics" by Emily Renshaw, 23–27; "A simple method of reconstructing a hyperbolic paraboloid" by E. J. Cuy (Couyundjopoulos), 28–29; "The national committee on mathematical requirements," 30–32; Editorials, Book Reviews, Notes and News, 33–40.

Messenger of Mathematics, volume 48, no. 9, January, 1919: "Note on the deflection of beams" by W. H. Macaulay, 129–130; "Laws of facility of error" by A. R. Forsyth, 131–144—No. 10, February: "On Napier's circular parts" by W. W. Johnson, 145–153 [Historical]; "Theorems in the expansion of polynomials, obtained by an application of the calculus of residues" by E. A. Milne, 153–159; "The dissection of rectilineal figures" by W. H. Macaulay, 159–160.

Nouvelles Annales de Mathématiques, volume 78, June, 1919: "Réduction à une forme normale d'un système d'équations différentielles simultanées linéaires à coefficients constants" by H. Vogt, 201–209; "Le théorème de Feuerbach dans les cubiques" by Malgouzon, 210–213; "Démonstration du théorème de Chasles sur les arcs égaux de lemniscate" by F. Balitrand, 213–215; "Sur les conditions pour qu'une fonction $P(x, y) + iQ(x, y)$ soit monogène" by M. Fréchet, 215–219; "Groupes de points sur l'hyperbole équilatère" by J. Ser, 220–228; Questions and solutions, 230–240.

Pennsylvania School Journal, volume 67, April, 1919: "The Courtis tests in arithmetic" by W. A. Boyer, 480–481.

Proceedings of the American Philosophical Society, volume 58, 1919: "Graphical representation of functions of the Nth degree" by F. E. Nipher, 236–240.

Revue de Métaphysique et de Morale, volume 26, no. 5, September–October, 1919: Etudes critiques—"Les Principes de l'analyse mathématique par Pierre Boutroux" by M. Winter, 649–667 [Last sentences: "Le livre que nous venons d'analyser donnera au jeune géomètre une vue d'ensemble de la science à laquelle il travaille. L'ouvrage de M. Boutroux intéressera également le philosophe; les grands courants de la pensée qui se dissimulent sous les théories mathématiques y sont discrètement décrits: l'auteur nous signale les heurts, les chocs qui en resultent. Il n'a pas cru devoir rester 'au-dessus de la mêlée'. Il a pris parti, il a défendu les idées qui nous semblent les plus conformes au développement de la science."]

Revue de Philosophie, année 19, no. 4: July–August, 1919: "Mathématique et métaphysique" by P. M. Périer, 384–395 (to be continued); "Pierre Duhem (1861–1916)", 457–462 [Quotations: "M. Duhem Pierre-Maurice-Marie naquit à Paris le 10 juin 1861. Elève du collège Stanislas, il se voue à l'étude des sciences et se prépare à l'Ecole Normale Supérieure. Il y est admis à l'âge de vingt et un ans. Son intelligence lucide, son travail obstiné, le font bientôt classer parmi les meilleurs sujets. Après ses trois années d'études, le nouvel agrégé, sorti premier du concours, aurait pu avoir hâte de jouir de la situation qu'il s'etait créée. Les deux années suivantes, il demanda et obtint la faveur de rester à l'Ecole en vue de perfectionner sa formation scientifique. . . . Peu d'hommes cependant ont été de tous points plus meritants que M. Duhem. Magnifiquement doué du point de vue intellectuel, à la fois *historien, philosophe* et surtout *savant,* il sut allier à la science abstraite des dispositions artistiques, qui ne laissaient pas de surprendre dans l'homme du chiffre et de l'abstraction. Partout où il s'offrait à lui, dans l'art, en littérature, dans l'architecture ou dans la nature, le beau ne le trouva jamais indifférent. Sa faculté esthétique n'explique-t-elle pas le charme singulier et la coloration de sa parole et surtout de sa claire composition?"].

Revue Philosophique de la France et de l'Etranger, année 44, September–October, 1919: "L'imagination pure et la pensée scientifique" by J. Segond, 297–321.

Revue scientifique, année 57, no. 17, 6–13 September, 1919: "Le temps et sa mesure" (suite) by M. Moulin, 517–527.

School Review, volume 27, no. 8, October, 1919: "Geometry by analysis" by H. O. Barnes, 612–618.

School and Society, volume 10, August 23, 1919: "What and how far have military courses and training contributed to the college curricula?" by P. P. Boyd, 219–224—October 11: "The National Committee on Mathematical Requirements," 435–437.

School Science and Mathematics, volume 19, no. 8, November, 1919: "A practical method for demonstrating the error of mean square" by H. F. Roberts, 677–692 [bibliography on page 692]; "How x came to stand for unknown quantity" by F. Cajori, 698–699 [Quotation: "As a matter of fact, there is no evidence, worthy of serious consideration, to show that x was used as the symbol for unknown quantity before the publication of Descartes' *Géométrie,* in 1637"]; "A 'flu' dream in mathematics" by W. A. Austin, 701–713; "Horner's method" by Elizabeth Sanford, 726 [First of five verses:

"Have you ever asked why asylums were filled
With people whose sweet dispositions were killed?
It's because of one man, with a Mother Goose name,
Who invented a system to drive folks insane.
That's Horner."];

"Force, work and power—their relation. Note on relation of work to heat added" by S. A. Garlick, 727–731; "Nineteenth meeting of the Central Association of science and mathematics teachers," 751; Problems and solutions, 755–758; "New outline map of the United States on the Lambert projection," 760; "The National Committee on Mathematical Requirements," 763–764; Review by G. A. Miller of Cajori's *History of Mathematics* (new edition, New York, 1919), 768, 770.

Science, new series, volume 50, November 7, 1919: Review by H. S. White of T. Smith and R. W. Cheshire's *Constructional Data for Small Telescope Objectives* and *Additional Data, etc.* (London, 1915–1916), 437–439—November 21: "The history of science and the American Historical Association" by E. J. Benton, 478; "The deflection of light by gravitation and the theory of relativity," 478–479—November 28: "The historical point of view in the teaching of science" by G. A. Miller, 489–493 [Address before the Missouri State Teachers Association. First two paragraphs: "The teachers of Missouri should take special interest in the history of science

at the present time in view of the fact that the American Association for the Advancement of Science is expected to meet soon in this state and the question of forming a special section of this association for the purpose of considering topics in the history of science is to be raised during this meeting. Teachers of mathematics have an additional reason for taking an unusually keen interest in this subject just now in view of the appearance during the past summer of two very important books on the history of their subject.

"One of these is entitled 'History of the Theory of Numbers' and was prepared by Professor L. E. Dickson of the University of Chicago, while the other bears the more general title 'A History of Mathematics' and was prepared by Professor Florian Cajori, of the University of California, who holds the unique position of a regular professorship of the history of mathematics in a university. The former book is the first volume of the most complete history of number theory ever written and marks an epoch in American mathematical literature, while the latter is technically only a 'revised and enlarged edition' of a book which appeared a quarter of a century ago under the same title, but the changes are so extensive that it too may be regarded as practically a new work."]

Scientific Monthly, volume 9, no. 5, November, 1919: "The controversy on the origin of our numerals" by F. Cajori, 458–464. [The article closes with the following summary: "The following are the outstanding facts:

1. The earliest reliable record of the use of our numerals with the zero is an inscription of 867 A.D. *in India.*
2. The validity of the testimony of early Arabic writers ascribing to India the numerals with the zero is shaken, but not destroyed.
3. There is not a scintilla of evidence in the form of old manuscripts or numeral inscriptions to support the Greek origin of our numerals.
4. At present the hypothesis of the Hindu origin of our numerals stands without any serious rival. But this hypothesis is by no means firmly established.

As a by-product of the discussion of recent years we must admit that, on the evidence presented, the claim that our numerals and the zero were used in India as early as the fifth century must be abandoned; our earliest apparently reliable evidence belongs to the ninth century. We must also abandon the claim that the early Hindus used the abacus, the rule of 'double false position,' and the process of 'casting out the nines.' These corrections are due to G. R. Kaye."]

University of Texas Bulletin, no. 1904, January, 1919: *A comparison of the premiums of the Teachers Insurance and Annuity Association with those of other legal reserve companies,* by E. L. Dodd, 19 pp.

UNDERGRADUATE MATHEMATICS CLUBS.

Edited by U. G. Mitchell, University of Kansas, Lawrence.

The Mathematics Club of the University of Kansas, Lawrence, Kansas. [*1918*, 35, 450, 459; *1919*, 208.]

The officers of the club for the year 1919–20 are as follows: President, Jessie Craig '20; vice-president, Beatrice Hagen '20; secretary-treasurer, Evelina Watt '20; reporter, Etna Morrison '20; faculty adviser, Professor Ellis B. Stouffer; program committee, the faculty adviser, the secretary, the reporter and Ruth Kelsey '20.

Below are given the programs for the year 1919–20, as announced in the printed folder issued by the club.

October 9, 1919: "Codes and Ciphers" by Professor Ulysses G. Mitchell.
October 23: "The game of nim" by Etna Morrison '20.